- *Incoming cellular calls do not add significantly to capacity requirements of cellular networks.* Only 14 percent of all minutes of use handled by cellular systems during the peak usage hour of 4:00 pm to 5:00 pm resulted from incoming calls versus 86 percent which resulted from outgoing calls.

CELLULAR CALLING DATA

The cellular calling data used in this study were derived by PNR and Associates from a proprietary PNR database. This database contains monthly billing information for local telephone, long distance, cellular telephone, and cable television services. The billing information for over 10,000 households was supplied voluntarily by a randomly selected sample during the Spring of 1995. These households are members of a national consumer panel and are surveyed as a group once a year.

Cellular telephone bills were collected from most of those households subscribing to cellular service, which comprised nearly 1,000 of the 10,000 participating households. Because these bills are obtained from households, rather than from business entities, the data in the billing database generally reflects cellular usage of residential cellular subscribers rather than business subscribers. These residential customer accounts may be used in whole or in part for business purposes, however. The billing data was not screened to exclude business-related calls from these accounts. Accordingly, the billing data may reflect a mix of business and personal calling patterns occurring on residential customer accounts.

The database compiled from the 1,000 cellular participants' cellular telephone bills contains specific telephone call information from 645 households and for over 16,000 calls, including the time, date, and duration of calls, whether calls are incoming or outgoing, and whether the called number is a landline or cellular telephone number. (The remaining cellular bills are from carriers not providing call detail or from households that made no cellular calls during that billing period.) These data were used to determine the proportion of cellular calls that are incoming (i.e., cellular-terminated) versus outgoing (i.e., cellular-originated), and the proportion of outgoing calls that are made to wireline versus cellular telephone numbers. In addition, these data were used to construct a time-of-day distribution of weekday cellular calling, which accounts for 80 percent of the total cellular calls and minutes of use.

WIRELINE CALLING DATA

Wireline time-of-day calling data were derived from a proprietary PNR database of 22 million local and toll calls made at several different central office switch locations. All calls made at those switch locations (local, toll, business, and residence) are included. The switch locations include urban, suburban, and rural areas.

RESULTS OF THE STUDY

"Outgoing" versus "Incoming" Cellular Calls

Table 1 below highlights the distribution of cellular telephone calls by whether they originate or terminate on cellular systems. Approximately 82 percent of all cellular calls in the database were "outgoing" in that they originated on the customers' cellular network, while 18 percent of all cellular calls in the database were incoming calls terminated on the customers' cellular network. Of the "outgoing" calls, approximately 98 percent terminated on a wireline telephone network, while 2 percent were terminated on a cellular telephone network.

Table 1

Distribution of Incoming and Outgoing Cellular Telephone Calls

Time of Day	Incoming Calls	Outgoing Calls
8 am to 6 pm	19%	81%
Other Hours	16%	84%
Total Calls	**18%**	**82%**

Cellular versus Wireline Time-of-Day Traffic Distributions

Table 2 and Charts 1 and 2 show the weekday call distributions and minutes-of-use distributions for both outgoing cellular and wireline calling hour by hour throughout the day. Both charts show that the time-of-day distribution of cellular calling is similar to that of wireline calling. For instance, peak usage of local wireline networks occurs between 10:00 am and 12:00 pm, when 16.3 percent of all minutes-of-use occur and between 3:00 pm and 5:00 pm when 15.3 percent of all minutes-of-use occur. Peak usage of cellular systems is very similar. By comparison, 13.8 percent of all minutes of cellular traffic occur between 10:00 am and 12:00 pm and 18.1 percent of all minutes of cellular traffic occur between 3:00 pm and 5:00 pm. The call distribution figures (i.e., number of calls per hour) yield similar results.

Table 2

Wireline versus Outgoing Cellular
Call Distribution and Minutes of Use Distribution
(Weekday Calls/Minutes by Hour)

TIME OF DAY	WIRELINE			CELLULAR		
Beginning Hour	% of Total Calls This Hour	% of Total Minutes This Hour	Average Minutes/Call	% of Total Calls This Hour	% of Total Minutes This Hour	Average Minutes/Call
8:00 am	5.28%	5.05%	2.94	4.25%	3.89%	1.99
9:00 am	7.81%	7.78%	3.07	6.02%	6.10%	2.20
10:00 am	8.74%	8.49%	2.99	7.14%	7.55%	2.29
11:00 am	8.70%	7.85%	2.78	6.46%	6.26%	2.10
12:00 pm	7.39%	6.57%	2.74	6.07%	5.72%	2.05
1:00 pm	7.71%	7.38%	2.94	7.45%	7.58%	2.21
2:00 pm	7.84%	7.31%	2.87	7.78%	8.57%	2.39
3:00 pm	8.59%	7.74%	2.77	8.64%	8.42%	2.12
4:00 pm	8.15%	7.51%	2.84	9.15%	9.63%	2.29
5:00 pm	6.53%	6.80%	3.20	9.91%	8.68%	1.90
6:00 pm	5.84%	6.49%	3.42	6.34%	6.14%	2.10
7:00 pm	4.42%	5.95%	4.14	4.57%	3.99%	1.89
8:00 pm	3.17%	4.37%	4.25	4.24%	4.99%	2.56
9:00 pm	2.01%	2.85%	4.36	3.76%	4.08%	2.36
10:00 pm	1.53%	2.39%	4.81	1.81%	2.13%	2.56
11:00 pm	0.75%	1.21%	4.90	0.67%	0.74%	2.40
Other Hours	5.52%	4.26%	2.37	5.75%	5.52%	2.08
Total	100.0%	100.0%		100.0%	100.0%	

Cellular Traffic Distributions by Type of Call and Time-of-Day

Tables 3 and 4 and Charts 3 and 4 highlight the weekday call distribution and minutes-of-use distribution for incoming, outgoing, and total cellular traffic. Both charts show that incoming calls and minutes-of-use account for a relatively small percentage of total usage and do not add significantly to network capacity requirements. For example, data depicted in Table 4 indicate that minutes-of-use of incoming cellular calls constitute only 14 percent of all cellular traffic during the hour of 4:00 pm to 5:00 pm when total usage of cellular capacity is at its peak. The remaining 86 percent of all total minutes of use during the peak cellular calling hour were occupied by outgoing calls.

Chart 1

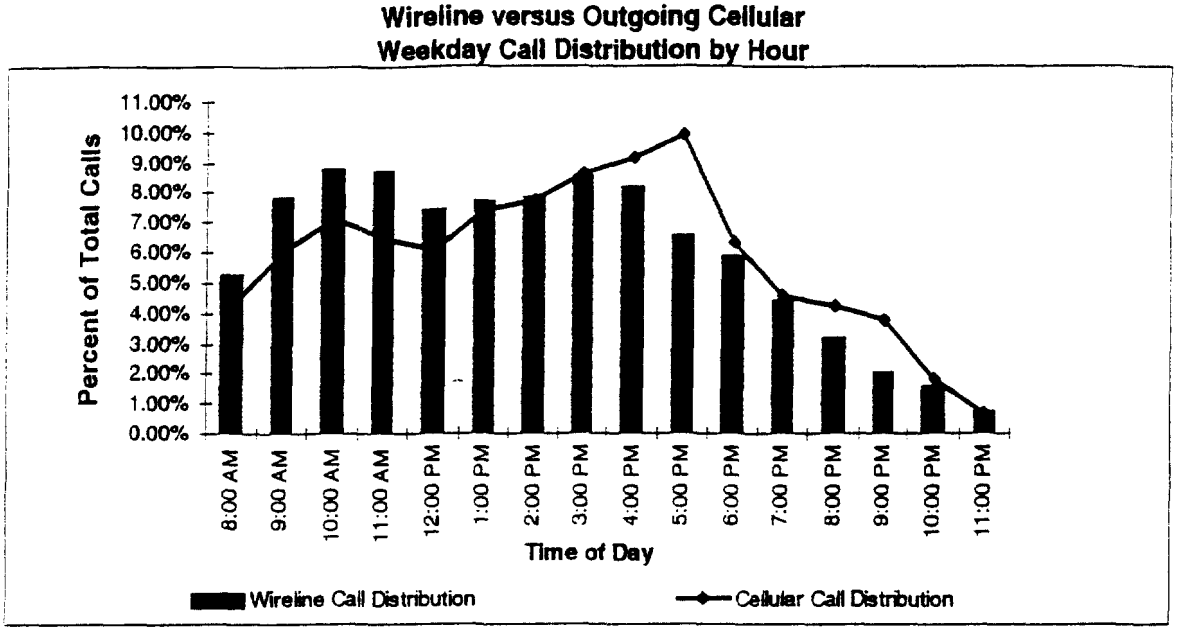


Chart 2

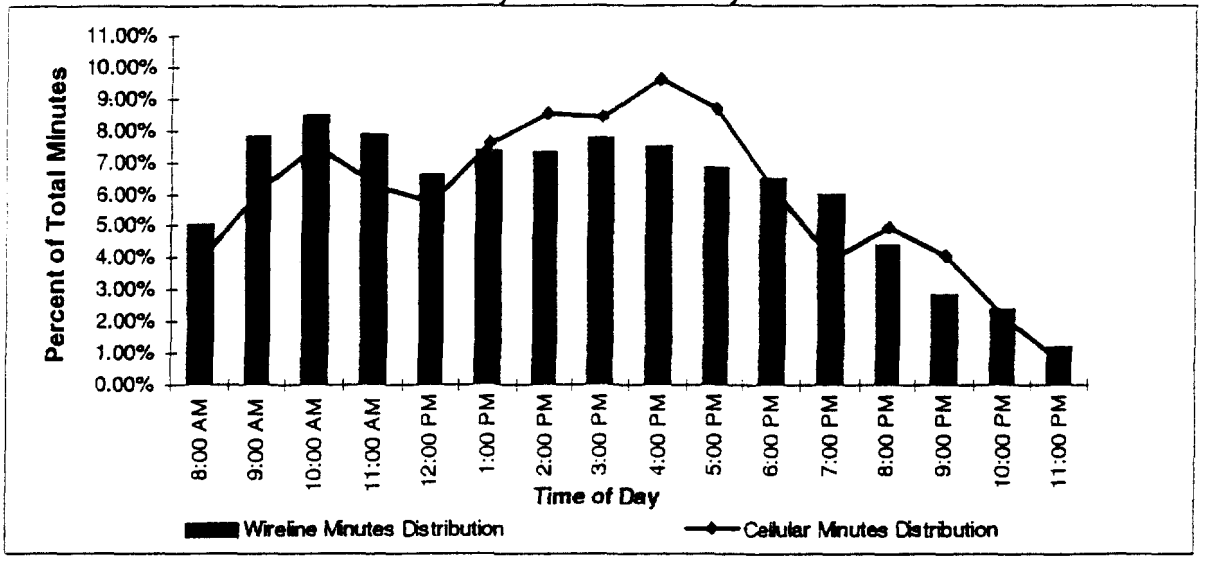


Table 3

Distribution of Cellular Calls by Time of Day (Weekday Calling)

TIME OF DAY	INCOMING CALLS			OUTGOING CALLS			TOTAL CALLS	
Beginning Hour	Number of Calls	Percent This Hour	% of Total This Hour	Number of Calls	Percent This Hour	% of Total This Hour	Number of Calls	Percent This Hour
8:00 am	110	4.56%	19.10%	466	4.25%	80.90%	576	4.31%
9:00 am	141	5.85%	17.60%	660	6.02%	82.40%	801	5.99%
10:00 am	196	8.13%	20.04%	782	7.14%	79.96%	978	7.32%
11:00 am	192	7.96%	21.33%	708	6.46%	78.67%	900	6.73%
12:00 pm	214	8.87%	24.35%	665	6.07%	75.65%	879	6.58%
1:00 pm	200	8.29%	19.69%	816	7.45%	80.31%	1016	7.60%
2:00 pm	166	6.88%	16.31%	852	7.78%	83.69%	1018	7.62%
3:00 pm	180	7.46%	15.99%	946	8.64%	84.01%	1126	8.42%
4:00 pm	198	8.21%	16.50%	1002	9.15%	83.50%	1200	8.98%
5:00 pm	229	9.49%	17.41%	1086	9.91%	82.59%	1315	9.84%
6:00 pm	155	6.43%	18.26%	694	6.34%	81.74%	849	6.35%
7:00 pm	106	4.39%	17.46%	501	4.57%	82.54%	607	4.54%
8:00 pm	69	2.86%	12.95%	464	4.24%	87.05%	533	3.99%
9:00 pm	66	2.74%	13.81%	412	3.76%	86.19%	478	3.58%
10:00 pm	25	1.04%	11.21%	198	1.81%	88.79%	223	1.67%
11:00 pm	18	0.75%	19.78%	73	0.67%	80.22%	91	0.68%
Other Hours	147	6.09%	18.92%	630	5.75%	81.08%	777	5.81%
Total	2,412	100.0%		10,955	100.0%		13,367	100.0%

Chart 3

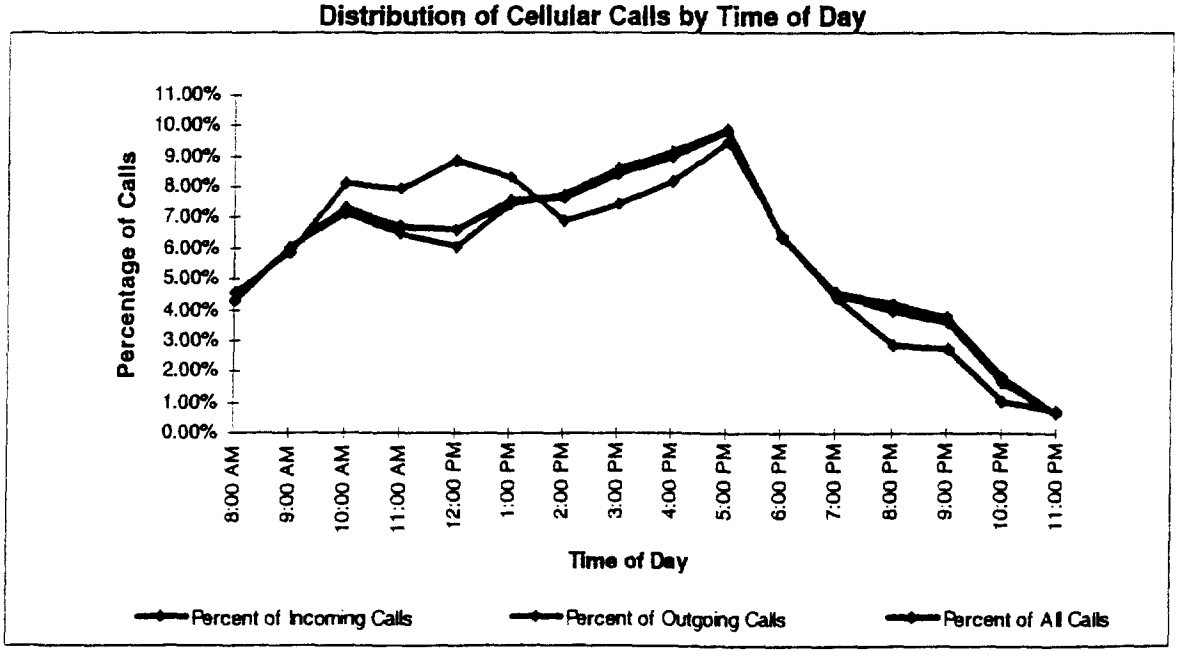
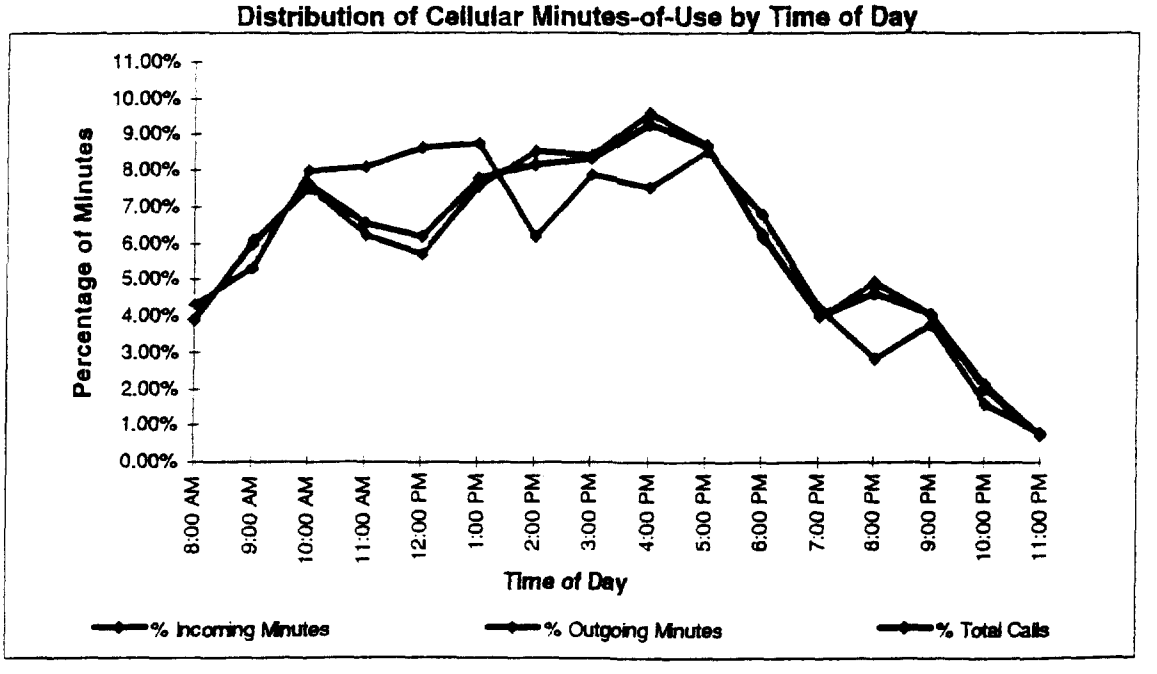


Table 4

Distribution of Cellular Minutes-of-Use by Time of Day
(Weekday Calling)

TIME OF DAY	INCOMING MINUTES			OUTGOING MINUTES			TOTAL MINUTES	
Beginning Hour	Number of Minutes	Percent This Hour	% of Total This Hour	Number of Minutes	Percent This Hour	% of Total This Hour	Number of Minutes	Percent This Hour
8:00 am	208	4.32%	18.34%	926	3.89%	81.66%	1134	3.97%
9:00 am	258	5.36%	15.11%	1450	6.10%	84.89%	1708	5.97%
10:00 am	386	8.02%	17.71%	1794	7.55%	82.29%	2180	7.63%
11:00 am	391	8.13%	20.80%	1489	6.26%	79.20%	1880	6.58%
12:00 pm	415	8.63%	23.37%	1361	5.72%	76.63%	1776	6.21%
1:00 pm	421	8.75%	18.93%	1803	7.58%	81.07%	2224	7.78%
2:00 pm	298	6.19%	12.76%	2038	8.57%	87.24%	2336	8.17%
3:00 pm	379	7.88%	15.91%	2003	8.42%	84.09%	2382	8.33%
4:00 pm	363	7.55%	13.68%	2290	9.63%	86.32%	2653	9.28%
5:00 pm	410	8.52%	16.57%	2064	8.68%	83.43%	2474	8.65%
6:00 pm	327	6.80%	18.31%	1459	6.14%	81.69%	1786	6.25%
7:00 pm	203	4.22%	17.62%	949	3.99%	82.38%	1152	4.03%
8:00 pm	136	2.83%	10.29%	1186	4.99%	89.71%	1322	4.62%
9:00 pm	183	3.80%	15.86%	971	4.08%	84.14%	1154	4.04%
10:00 pm	76	1.58%	13.06%	506	2.13%	86.94%	582	2.04%
11:00 pm	38	0.79%	17.84%	175	0.74%	82.16%	213	0.75%
Other Hours	319	6.63%	19.56%	1312	5.52%	80.44%	1631	5.71%
Total	4,811	100.0%		23,776	100.0%		28,587	100.0%

Chart 4



CONCLUSIONS

The data presented above provide a quantitative basis for evaluating the assumptions underlying the Commission's "bill and keep" proposal. The data show that neither of the conditions predicated by the Commission for utilization of a mandatory "bill and keep" scheme is satisfied.

With respect to the first predicate on which "bill and keep" could be based -- that LEC-interconnected CMRS traffic is balanced between incoming and outgoing -- the data show that this is not the case. Instead, the data indicate a substantial imbalance between cellular-originated and wireline-originated traffic. Specifically, the data demonstrate that for residential cellular customers the ratio of outgoing to incoming calls is 82 to 18. The study further indicates that the proportion of outgoing cellular traffic that does not utilize LEC interconnections (i.e., calls between cellular telephone numbers) is less than 2 percent.

With respect to the second predicate on which "bill and keep" could be based -- that the cost of terminating CMRS calls on LEC networks is negligible -- the data indicate that this too is not the case. The analysis underlying the Commission's tentative belief that the second condition could be true is premised on the assumption that the peak hours of CMRS traffic are different from the peak hours for wireline traffic, and that accordingly the LEC's termination of peak-hour CMRS-originated traffic occurs during the LEC's off-peak hours, thereby imposing *de minimis* incremental costs on the LEC. The data suggest that this assumption is not valid because the peak hours for both cellular and wireline traffic are similar. The termination of the cellular carrier's peak-hour traffic on the LEC's network occurs during the hours of peak wireline network usage. Accordingly, the termination of cellular-originated traffic by the LEC will cause the LEC to incur incremental costs that cannot be assumed to be *de minimis*.

Finally, because cellular minutes-of-use for incoming calls represents such a small portion (e.g., 14 percent) of total traffic handled by cellular providers during the peak calling hour of 4:00 pm to 5:00 pm, the incremental cost of terminating LEC originated traffic on cellular systems appears to be relatively low, albeit not zero.

Attachment A

A. Wireline versus Outgoing Cellular Weekday Average Minutes per Call

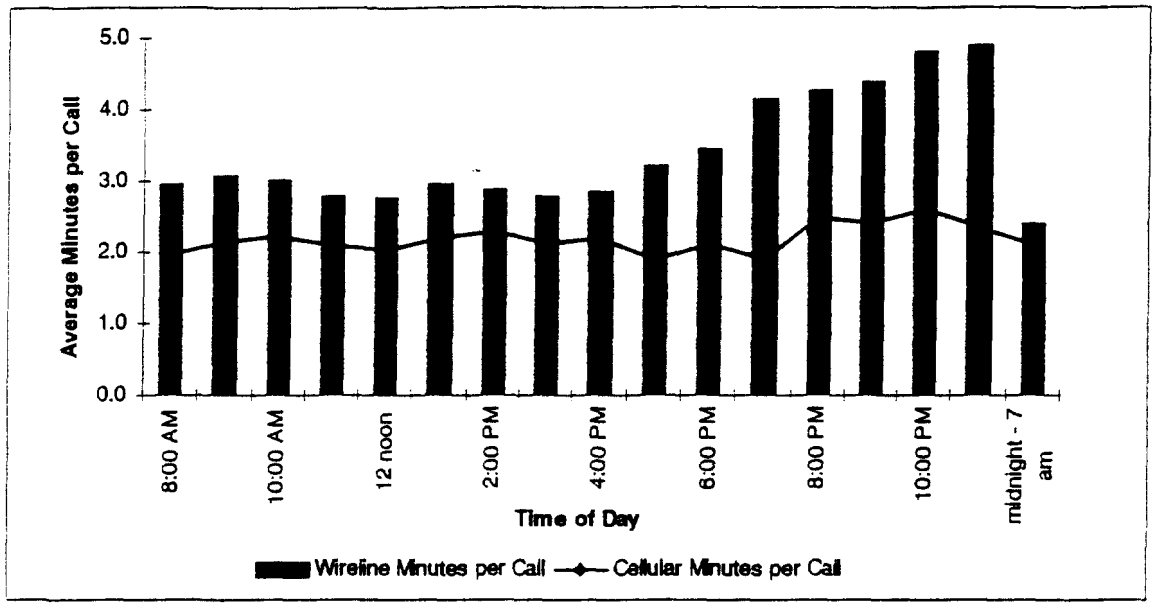
B. Outgoing Cellular Calling Patterns - Weekday versus Weekend

C. Outgoing Cellular Calling Patterns by Income - Call Distribution by Time of Day

D. Outgoing Cellular Calling Patterns by Income - Minutes-of-Use Distribution by Time of Day

Chart A

Wireline versus Outgoing Cellular
Weekday Average Minutes per Call



Charts B.1-3

Outgoing Cellular Calling Patterns
Weekday versus Weekend

Chart B1 - Cellular Calls

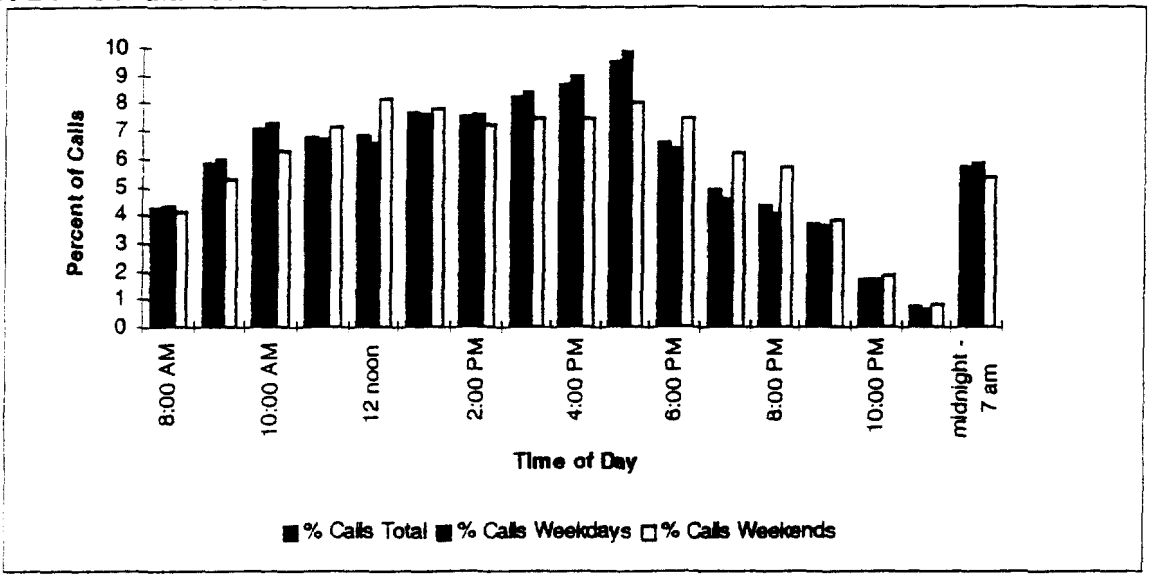


Chart B2 - Cellular Minutes of Use

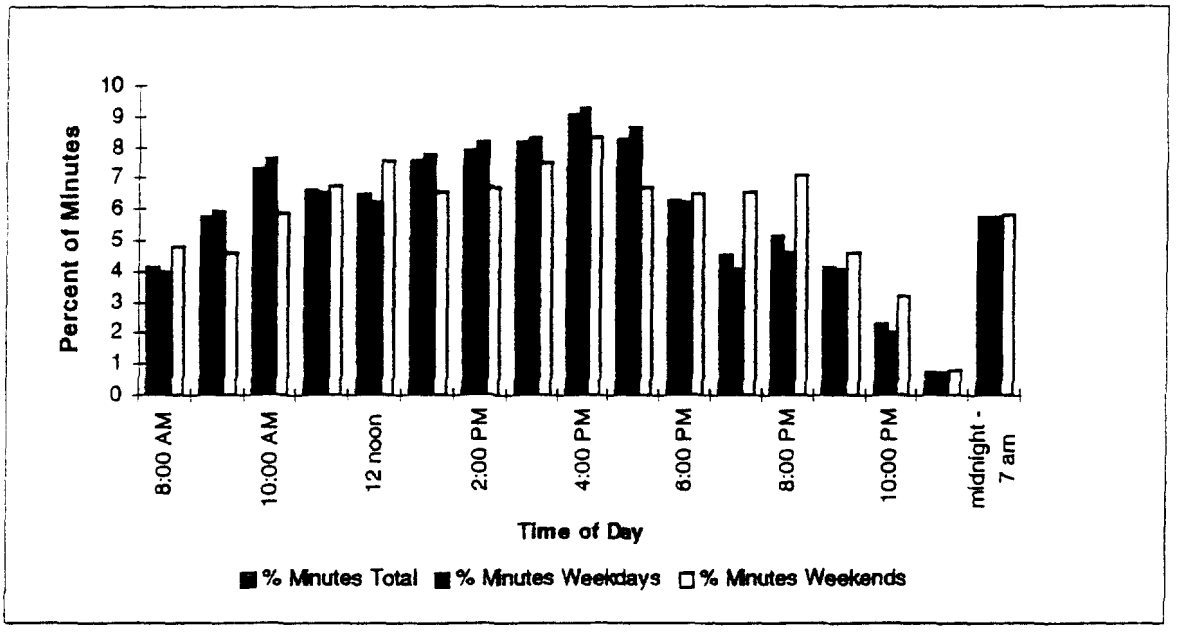


Chart B3 - Cellular Minutes per Call

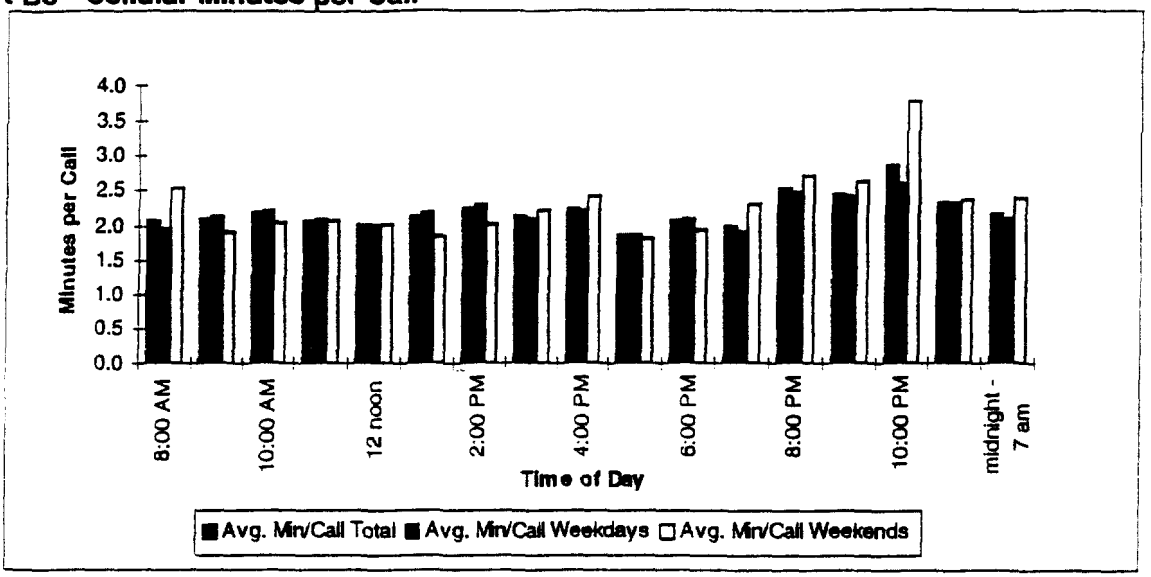
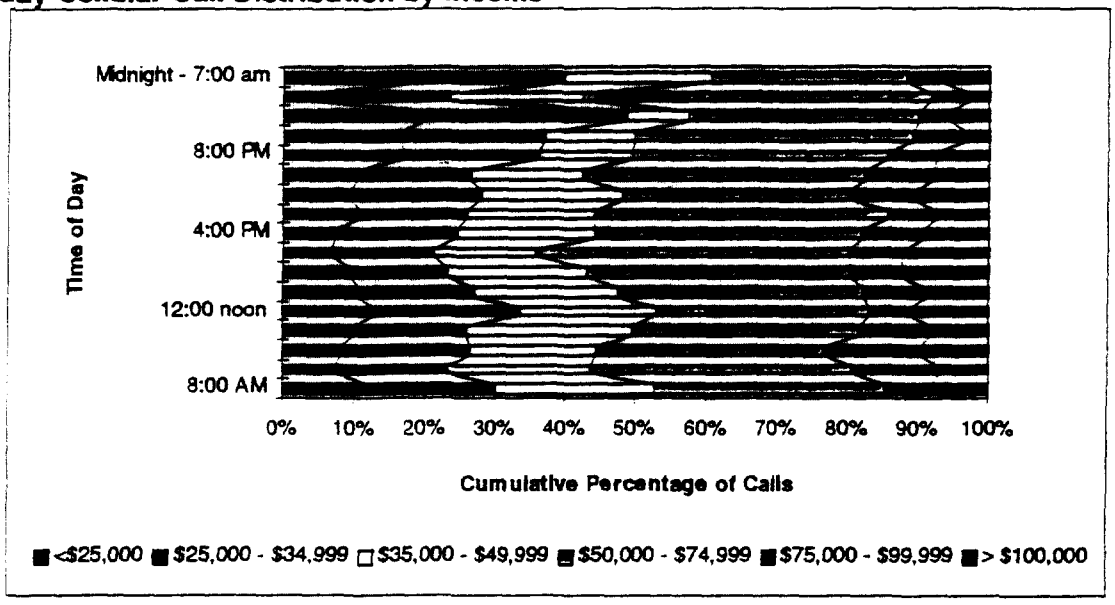


Chart C

Outgoing Cellular Calling Patterns by Income
Call Distribution by Time of Day

Weekday Cellular Call Distribution by Income



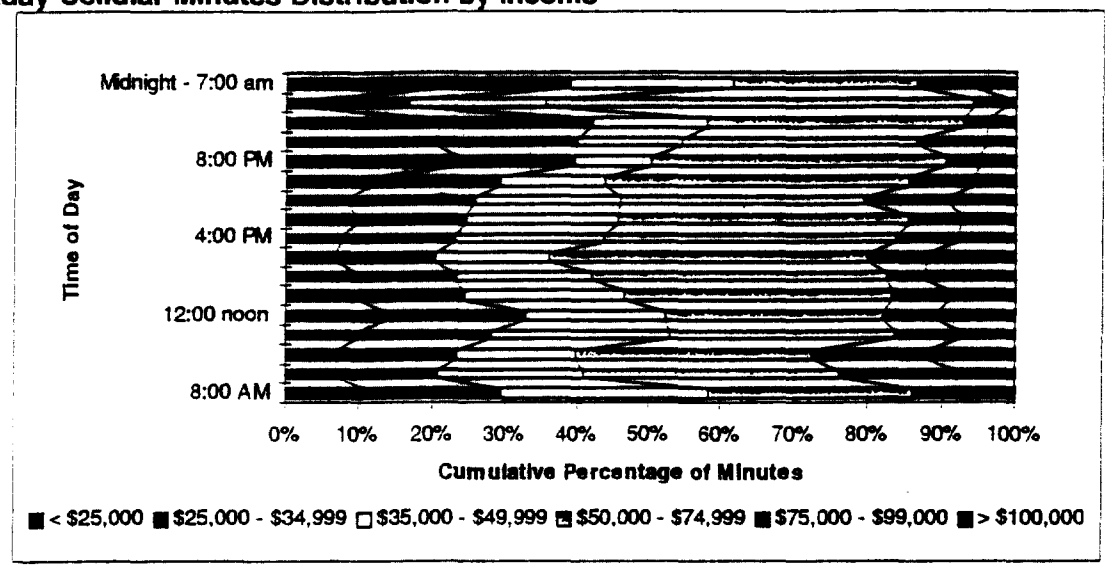
Weekday Cellular Call Distribution (percent) by Time & Income

	10.59	17.32	18.75	36.04	8.43	8.88	100
	12.02	18.03	22.75	32.4	6.65	8.15	4.25
	7.27	15.91	20.45	36.82	12.73	6.82	6.02
	8.06	18.41	17.9	32.23	13.81	9.59	7.14
	9.75	16.1	23.73	32.2	9.89	8.33	6.46
	12.78	20.75	19.55	29.92	6.02	10.98	6.07
	10.54	16.42	20.59	34.56	9.07	8.82	7.45
	9.39	13.73	20.07	36.97	7.28	12.56	7.78
	6.55	14.69	14.69	44.4	7.4	12.26	8.64
	7.19	17.27	19.66	37.82	8.98	9.08	9.15
	10.87	14.92	18.42	41.62	6.72	7.46	9.91
	9.51	18.3	20.32	32.13	9.22	10.52	6.34
	10.18	16.17	16.17	39.92	9.78	7.78	4.57
	16.81	19.4	13.15	36.21	6.9	7.54	4.24
	16.26	20.63	12.86	39.32	7.52	3.4	3.76
	19.7	28.79	9.09	32.32	4.55	5.56	1.81
	4.11	19.18	19.18	49.32	5.48	2.74	0.67
	18.57	21.11	20.95	27.62	5.08	6.67	5.75

Chart D

Outgoing Cellular Calling Patterns by Income
Minutes-of-Use Distribution by Time of Day

Weekday Cellular Minutes Distribution by Income



Weekday Cellular Minutes Distribution (percent) by Time & Income

At Least / Less Than:	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total	11.08	16.08	19.49	36.18	8.71	8.47	100
8:00 am	11.34	18.03	28.94	27.75	5.94	7.99	3.89
9:00 am	6.83	13.86	20.14	35.24	15.79	8.14	6.1
10:00 am	6.86	16.5	16.56	32.44	15.61	12.04	7.55
11:00 am	9.67	18.4	24.85	30.69	9.07	7.32	6.26
12:00 noon	13.59	19.32	19.4	29.9	7.05	10.73	5.72
1:00 pm	9.98	14.25	22.41	36.38	8.15	8.82	7.58
2:00 pm	9.81	13.2	18.84	40.73	5.2	12.22	8.57
3:00 pm	6.59	13.68	15.83	43.98	7.84	12.08	8.42
4:00 pm	7.42	15.63	20.92	39.96	8.43	7.64	9.63
5:00 pm	9.74	14.73	21.27	39.92	7.12	7.22	8.68
6:00 pm	8.29	17.41	20.29	33.31	11.65	9.05	6.14
7:00 pm	11.38	17.7	14.86	41.52	8.96	5.58	3.99
8:00 pm	23.61	15.85	10.88	40.3	4.64	4.72	4.99
9:00 pm	20.39	19.36	14.73	32.23	9.17	4.12	4.08
10:00 pm	20.95	20.95	16.01	35.18	3.16	3.75	2.13
11:00 pm	2.29	14.29	18.86	58.86	4.57	1.14	0.74
Other Hours	21.27	17.53	22.64	25.15	7.77	5.64	5.52